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Research Abstracts

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CURRENT NACA REPORTS

NACA Rept. 1007

HORIZONTAL TAIL LOADS IN MANEUVERING FLIGHT. Henry A. Pearson, William A. McGowan and James J. Donegan. 1951. ii, 12p. diagrs., 2 tabs. (NACA Rept. 1007. Formerly TN 2078)

A method is derived for determining the horizontal tail load following a prescribed maneuver. The tail load is broken down into various components which are examined to determine the maximum values. The method is extended to include suggestions for distributing the load across the span as well as in a chordwise direction. Equations are given for determining the maximum possible pitching angular velocity and pitching acceleration in a pull-up maneuver.

NACA TN 2451

MATHEMATICAL IMPROVEMENT OF METHOD FOR COMPUTING POISSON INTEGRALS INVOLVED IN DETERMINATION OF VELOCITY DISTRIBUTION ON AIRFOILS. I. Flügge-Lotz, Stanford University. October 1951. 84p. diagrs., 3 tabs. (NACA TN 2451)

A solution is presented of the Poisson integral involved in the determination of the change in velocity distribution resulting from a change in airfoil profile in parallel incompressible flow. Three well developed numerical methods of evaluating this integral, all based on the division of the range of integration into small equal intervals, and the difficulties involved in each method, are discussed. A new method based on the use of unequal intervals, is developed and compared with the other methods by means of several examples.

NACA TN 2465

EXPERIMENTAL AERODYNAMIC DERIVATIVES OF A SINUSOIDALLY OSCILLATING AIRFOIL IN TWO-DIMENSIONAL FLOW. Robert L. Halfman, Massachusetts Institute of Technology. November 1951. 83p. diagrs., photo., 19 tabs. (NACA TN 2465)

Experimental measurements of the aerodynamic reactions on a symmetrical airfoil oscillating harmonically in a two-dimensional flow are presented and analyzed. Harmonic motions include pure pitch and pure translation, for several amplitudes and superimposed on an initial angle of attack, as well as combined pitch and translation. Considerable consistent data for pure pitch were obtained from a search of available reference material, and several definite Reynolds number effects are evident.

NACA TN 2473

ON THE SPECTRUM OF ISOTROPIC TURBULENCE. H. W. Liepmann, J. Laufer and Kate Liepmann, California Institute of Technology. November 1951. 61p. diagrs. (NACA TN 2473)

Measurements of the spectrum and correlation functions at large Reynolds numbers were made, as well as a series of accurate spectrum measurements at lower Reynolds numbers, and the results are compared with theory. The second, fourth, and sixth moments of the spectrum were computed from the measurements and are discussed in relation to theoretical results. The significance of the number of zeros of the fluctuating velocity components was investigated and examples of measurements for the determination of the microscale of turbulence from zero counts are presented.

NACA TN 2493

ANALYSIS OF AN AXIAL COMPRESSOR STAGE WITH INFINITESIMAL AND FINITE BLADE SPACING. H. J. Reissner and L. Meyerhoff, Polytechnic Institute of Brooklyn. October 1951. 32p. diagrs. (NACA TN 2493)

A method of designing circular blade systems of finite spacing is developed. First, the theory of flow through a system of infinitesimally spaced surfaces is formulated by means of a continuous axially symmetric force field which is uniform in the circumferential direction. This force field replaces the effect of the blade system, with its hub and shroud boundary surfaces. Second, the force field in the space between the blades, hub, and shroud is replated in the equations of finite spacing by inertia and pressure terms, which were omitted in equations of infinitesimal spacing. These terms will change values of flow variables of infinitesimal spacing.

NACA TN 2495

WIND-TUNNEL INVESTIGATION OF EFFECTS OF VARIOUS AERODYNAMIC BALANCE SHAPES AND SWEEPBACK ON CONTROL-SURFACE CHARACTERISTICS OF SEMISPAN TAIL SURFACES WITH NACA 0009, 0015, 66-009, 66(215)-014, AND CIRCULAR-ARC AIRFOIL SECTIONS. John J. Harper, Georgia Institute of Technology. October 1951. 127p. diagrs., photos., 5 tabs. (NACA TN 2495)

A summary of force data on unswept and sweptback airplane control surfaces is presented. Lift and hinge-moment characteristics were determined for

four unswept, semispan control surfaces, and lift, drag, hinge moment, and pitching moment were determined for two semispan, sweptback control surfaces. These control surfaces were of the wide-chord type suitable for use as elevators or rudders. Measured values of the various parameters are compared with those obtained from section data by application of lifting-surface and lifting-line theory.

NACA TN 2503

HYDRODYNAMIC INVESTIGATION OF A SERIES OF HULL MODELS SUITABLE FOR SMALL FLYING BOATS AND AMPHIBIANS. W. C. Hugli, Jr. and W. C. Axt, Stevens Institute of Technology. November 1951. 122p. diagrs., photos., 4 tabs. (NACA TN 2503)

Results of an investigation to obtain hydrodynamic information on a series of hull models suitable for small flying boats or amphibians of from 2000 to 5000 pounds gross weight are presented. The series of hulls consisted of a basic hull with simple lines with plus or minus variations to this design in which the beam, sternpost angle, and afterbody length were altered. Modifications were also investigated to determine the advantage of refining the hull lines. The hulls were tested for hydrodynamic resistance and main spray. On the basis of these characteristics, the best beam and sternpost angle were selected for each of the three afterbody lengths investigated. The resulting three hulls were further tested for landing and porpoising characteristics.

NACA TN 2512

STRESSES IN A TWO-BAY NONCIRCULAR CYLINDER UNDER TRANSVERSE LOADS. George E. Griffith. October 1951. 34p. diagrs., 3 tabs. (NACA TN 2512)

A method, taking into account the effects of flexibility and based on a general eighth-order differential equation, is presented for finding the stresses in a two-bay, noncircular cylinder the cross section of which can be composed of circular arcs. Numerical examples are given for two cases of ring flexibility for a cylinder of doubly symmetrical (essentially elliptic) cross section, subjected to concentrated radial, moment, and tangential loads. The results parallel those already obtained for shells with circular rings.

NACA TN 2514

RELATIVE STRUCTURAL EFFICIENCIES OF FLAT BALSA-CORE SANDWICH AND STIFFENED-PANEL CONSTRUCTION. Ralph E. Hubka, Norris F. Dow and Paul Seide. October 1951. 29p. diagrs. (NACA TN 2514)

An analysis is made and charts are presented for the determination of regions of efficient application of flat balsa-core sandwich and stiffened-panel construction for a large range of design requirements. Optimum sandwiches were found to have relatively low values of the ratio of core thickness to face thickness.

NACA TN 2515

THE LINEARIZED CHARACTERISTICS METHOD AND ITS APPLICATION TO PRACTICAL NON-LINEAR SUPERSONIC PROBLEMS. Antonio Ferri. October 1951. 65p. diagrs. (NACA TN 2515)

The method of characteristics has been linearized by assuming that the flow field can be represented as a basic flow field determined by nonlinearized methods and a linearized superposed flow field that considers small changes in boundary conditions. The method has been applied to two-dimensional rotational flow, to calculations of axially symmetric flow, to slender bodies without symmetry, and to wing problems.

NACA TN 2516

A SURVEY OF CREEP IN METALS. A. D. Schwope and L. R. Jackson, Battelle Memorial Institute. November 1951. 66p. diagrs., tab. (NACA TN 2516)

This report summarizes numerous theories relating to creep phenomena and the extent of current knowledge on the subject. Various possible mechanisms by which creep occurs both in single crystals and in polycrystals are described. An extensive bibliography of published works in this field is also included.

NACA TN 2522

A GRAPHICAL METHOD FOR PLOTTING AMPLITUDE AND PHASE ANGLE OF TRANSFER FUNCTIONS OF DYNAMIC SYSTEMS WITHOUT FACTORING POLYNOMIALS. Earl F. Smith. November 1951. 35p. diagrs., 4 tabs. (NACA TN 2522)

A method is presented for obtaining amplitude and angle plots for rational algebraic functions of an imaginary variable. The method involves the use of templets but does not require the factoring of polynomials. Application of the method is illustrated by by an example in which the frequency response of an aircraft and automatic control system is plotted.

NACA TN 2523

ROTOGENERATIVE DETECTION OF CORROSION CURRENTS. Joseph B. McAndrew, William H. Colner and Howard T. Francis, Armour Research Foundation. November 1951. 12p. photos., diagrs. (NACA TN 2523)

A new technique for studying corrosion phenomena is described which permits the detection of the presence of currents produced by local cells on the surface of a corroding metal specimen. A cylindrical specimen is rotated at several hundred revolutions per minute in the corrosion medium. A small reference electrode is positioned as near the specimen as possible, thus scanning the surface of the metal. The signal produced is amplified and applied to an oscilloscope, together with a suitably synchronized sweep voltage. A standing pattern is produced on the oscilloscope which is a reproduction of the potential fields set up in the corrosion medium by the currents flowing between the elements of local cells.

NACA TN 2524

AN INVESTIGATION OF AIRCRAFT HEATERS. XXXVIII - DETERMINATION OF THERMAL PERFORMANCE OF RECTANGULAR- AND TRAPEZOIDAL-SHAPED INNER-SKIN PASSAGES FOR ANTI-ICING SYSTEMS. L. M. K. Boelter, V. D. Sanders and F. E. Romie, University of California. November 1951. 21p. diagrs., photos. (NACA TN 2524)

An investigation was conducted to determine the thermal and hydrodynamic behavior of air in the downstream portion of two types of double-skin passages used in heated-air leading-edge anti-icing systems. The downstream average unit thermal conductance in the turbulent region was 30 to 35 percent below that given by the commonly used equations. In the laminar region, the experimental unit conductance was about 30 percent below the predicted values for rectangular ducts but for trapezoidal ducts the data were much lower than the predicted values.

NACA TN 2525

THE EFFECT OF RATE OF CHANGE OF ANGLE OF ATTACK ON THE MAXIMUM LIFT COEFFICIENT OF A PURSUIT AIRPLANE. Burnett L. Gadeberg. October 1951. 17p. diagrs., photo. (NACA TN 2525. Formerly RM A8I30)

Flight tests have been made with a pursuit airplane to determine the effect of Mach and Reynolds numbers on the variation of the rate of change of maximum lift coefficient with rate of change of angle of attack. These tests have indicated that the rate of increase of maximum lift coefficient with increasing abruptness of the stall is significantly affected by Reynolds number as well as Mach number. Both parameters reduce this rate of increase over the lower ranges tested and increase it in the higher ranges.

NACA TN 2528

A METHOD FOR PREDICTING THE UPWASH ANGLES INDUCED AT THE PROPELLER PLANE OF A COMBINATION OF BODIES WITH AN UNSWEPT WING. Paul F. Yaggy. October 1951. 24p. diagrs., photos. (NACA TN 2528)

An approximate method for predicting the upwash angles induced at the horizontal center line of the propeller disk of a twin-engine airplane is developed and is shown to be satisfactory. The applicability of the method to other airplanes is discussed.

NACA TN 2529

SECONDARY STRESSES IN THIN-WALLED BEAMS WITH CLOSED CROSS SECTIONS. Stanley Urner Benscoter, California Institute of Technology. October 1951. 104p. diagrs. (NACA TN 2529)

An accurate method of determining secondary stresses in thin-walled, uniform beams of closed cross section is presented. The cross sections are assumed to be preserved by closely spaced rigid diaphragms. In the first section of the paper the integrodifferential equation governing axial displacements is formulated and solved for a beam without longitudinal stiffeners. In the second section of the paper the corresponding summation-difference equation is developed and solved for a beam with stiffeners (flanges and stringers). The cross section, loading distribution, and end conditions are assumed to be arbitrary.

NACA TN 2531
National Advisory Committee for Aeronautics.
SIMPLIFIED METHOD FOR CALCULATION OF COMPRESSIBLE LAMINAR BOUNDARY LAYER WITH ARBITRARY FREE-STREAM PRESSURE GRADIENT. George M. Low. October 1951. 28p. diagrs., 2 tabs. (NACA TN 2531)

The Kármán-Polhausen method, as applied to compressible laminar boundary layers, is simplified by an analysis similar to the incompressible Holstein-Bohlen method. The analysis is carried out under the assumptions of a Prandtl number of 1, zero heat transfer, and a linear viscosity-temperature relation. Results are presented so that velocity and temperature profiles, momentum and displacement thicknesses, and wall shear stress can be calculated for flows over two-dimensional bodies with arbitrary free-stream velocity distributions. The results are also applicable to flows over three-dimensional bodies with axial symmetry through the use of Mangler's transformation.

NACA TN 2532
National Advisory Committee for Aeronautics.
X-RAY DIFFRACTION STUDY OF THE INTERNAL STRUCTURE OF SUPERCOOLED WATER. Robert G. Dorsch and Bemrose Boyd. October 1951. 14p. diagrs., photo. (NACA TN 2532)

X-ray diffraction data for water in the temperature range 21° to -16° C are presented. The minimum between the two main diffraction peaks deepened continuously, as the temperature was lowered. It is concluded that supercooled water apparently becomes progressively more ice-like in structure as the temperature is lowered.

NACA TN 2535
National Advisory Committee for Aeronautics.
MINIMUM WAVE DRAG OF BODIES OF REVOLUTION WITH A CYLINDRICAL CENTER SECTION. Franklyn B. Fuller and Benjamin R. Briggs. October 1951. 34p. diagrs. (NACA TN 2535)

The minimum wave-drag problem with auxiliary conditions is solved for axial flow about bodies of revolution consisting of two symmetrical ogival sections joined by a circular cylinder. The auxiliary conditions are that the total length, the length of the cylinder, the frontal area, and the volume are held constant. The results are related to similar results known for bodies of revolution without a cylindrical midsection, and it is found that the addition of small amounts of center section has little effect on the drag. The maximum thickness ratio leading to the least total of wave and friction drag is investigated briefly.

NACA TN 2545

DISCREPANCIES BETWEEN THEORETICAL AND OBSERVED BEHAVIOR OF CYCLICALLY LOADED BEARINGS. R. W. Dayton, E. M. Simons and F. A. Fend, Battelle Memorial Institute. November 1951. 27p. diagrs., photos. (NACA TN 2545)

Discrepancies between theory and the experimental behavior of a cyclically loaded shaft rotating in a sleeve bearing are analyzed. For constant loads rotating at one-half the frequency of shaft rotation, eccentricity ratios were found to be unity when kerosene was used to lubricate the test bearing. This agrees with theoretical predictions. However, when SAE 10 oil was used, the eccentricity ratios were reduced. Under the latter conditions, the eccentricity ratio decreased as the shaft speed increased. Refinements of the test conditions resulted in observed eccentricity ratios which were closer to the theoretically predicted value of unity.

NACA RM E51H31

A MULTIPLE-RANGE SELF-BALANCING THERMOCOUPLE POTENTIOMETER. I. Warshawsky and M. Estrin. November 1951. 15p. diagrs., photo., 2 tabs. (NACA RM E51H31)

A multiple-range potentiometer circuit is described that provides automatic measurement of temperatures or temperature differences with any one of several thermocouple-material pairs. Techniques of automatic reference-junction compensation, span adjustment, and zero suppression are described that permit rapid selection of range and wire material, without the necessity for restandardization, by setting of two external tap switches.

NACA TM 1308

ON MOTION OF FLUID IN BOUNDARY LAYER NEAR LINE OF INTERSECTION OF TWO PLANES. (O Dvizhenii Zhidkosti v Pogranichnom Sloe Vblizi Linii Peresechenia Dvukh Ploskostei). L. G. Loitsianskii and V. P. Bolshakov. November 1951. 27p. diagrs., 4 tabs. (NACA TM 1308. Trans. from Central Aero-Hydrodynamical Institute, Transactions, Rept.279, 1936, p.3-18).

A motion of a slightly viscous incompressible fluid that flows between two semi-infinite planes which intersect at an angle between 0^{o} and 180^{o} is discussed. The increase in thickness of the boundary layer near the line of intersection of the two planes, the limits of the effect of the corner, and the effect on the drag are determined. The analysis is made for both laminar and turbulent flow by using the momentum theorem and assuming suitable velocity profiles.

NACA TM 1309

ON THE THEORY OF THIN AND THIN-WALLED RODS. (K. Teorii Tonkikh i Tonkostennykh Sterzhnei). G. Y. Dzhanelidze. October 1951. 18p. tab. (NACA TM 1309. Trans. from Prikladnaya Matematika i Mekhanika, v.13, Nov.-Dec.1949, p.597-608).

An approximate theory for the torsion and bending of thin shells is developed. The theory is based on two fundamental assumptions: cross sections are unstrained in their own planes, and the longitudinal strain in the cross section can be represented by a planar distribution (the usual engineering assumption) and by a distribution proportional to the St. Venant warping. The torsion and bending problems are discussed in the light of these assumptions; the analysis is then applied to the free vibration of a thin shell in combined torsion and bending.

NACA TM 1311

CONTRIBUTIONS TO THE THEORY OF THE SPREADING OF A FREE JET ISSUING FROM A NOZZLE. (Zur Theorie der Ausbreitung eines aus einer Düse austretenden freien Strahls). W. Szablewski. November 1951. 72p. diagrs. (NACA TM 1311. Trans. from Zentrale für wissenschaftliches Berichtswesen der Luftfahrtforschung, Berlin. UM 8003, September 1944).

For the flow field of a free jet leaving a nozzle of circular cross section in a medium with straight uniform flow field, approximate formulas are presented for the calculation of the velocity distribution and the dimensions of the core region. The agreement with experimental results is satisfactory.

NACA TM 1320

INVESTIGATIONS ON WINGS WITH AND WITHOUT SWEEPBACK AT HIGH SUBSONIC SPEEDS. (Untersuchungen an gepfeilten und ungepfeilten Flügeln bei hohen Unterschallgeschwindigkeiten). Jakob Ackeret, Max Degen and Nikolaus Rott. November 1951. 14p. diagrs., photos. (NACA TM 1320. Trans. from Zeitschrift für angewandte Mathematik und Physik, v.1, 1950, p.32-42).

Drag tests at zero lift have been made at Mach numbers from 0.7 to approximately 0.95 in the high speed wind tunnel of the Institute for Aerodynamics, ETH, Zürich, on a group of untapered wings of aspect ratio 3.25, having sweep angles of 0^{o} and 35^{o}. For each sweep angle, a series of geometrically similar models was tested at a constant Reynolds number to provide a verification of computed tunnel blocking corrections. Tests were also made for wings having thickness ratios of 0.09 and 0.12 and the results compared with results predicted by von Kármán's similarity law.

NACA TM 1323

INFLUENCE OF STATIC LONGITUDINAL STABILITY ON THE BEHAVIOR OF AIRPLANES IN GUSTS. (Einfluss der statischen Längsstabilität auf das Verhalten eines Flugzeuges in Böen). H. Hoene. November 1951. 26p. diagrs. (NACA TM 1323. Trans. from Zentrale für wissenschaftliches Berichtswesen der Luftfahrtforschung, Berlin. FB 1422, December 31, 1940).

The equations of motion for an airplane penetrating a gust are derived using a few simplifying assumptions. Calculations of loads for different static longitudinal stability on two German airplane models,

HC 45 and HS 122, are compared with flight tests. Good agreement is obtained between the trend of the flight tests and the calculated values; however no absolute comparison was possible between the flight tests and calculations.

BRITISH REPORTS

N-2414*

Department of Supply (Australia)
CORROSION OF METALS. METALS UNDER STRESS: I. ALUMINIUM. P. F. Thompson. July 1950. 22p. photos., diagrs. (Department of Supply. ACA-49)

Discusses the corrosion of aluminum under stress. Gives time-potential curves determined simultaneously of stressed and unstressed electrodes of commercially pure aluminum. Test pieces of various shapes were used. Determinations were made in various liquids, including distilled water, tap water, salt solutions and sea water; and so that full assessment of the oxidizing potentials could be made, these solutions were examined under full aeration and under complete deaeration. The conclusions following on the work of this report indicate that stresses are but contributory factors in the so-called process of "stress-corrosion."

N-4904*

Department of Supply (Australia)
OBSERVATION OF THE LUBRICATING OIL FILM BETWEEN PISTON RING AND CYLINDER OF A RUNNING ENGINE. THE EFFECT OF RING GEOMETRY. R. L. Brooks and M. L. Atkin. November 1950. 13p. diagrs., photos. (Department of Supply. ACA-52)

The effect of ring geometry on lubrication between the top piston ring and cylinder wall of a single cylinder aircraft engine was studied by measuring the electrical contact resistance. Torsion rings gave better results than square section rings of corresponding designs. Tapered leading edges were effective in promoting the rapid formation and maintenance of an oil film. Chamfered edges did not effect any improvement. Rings which were tapered across the full bearing faces gave traces which had a sawtooth appearance, with severe breakdowns at the bottom centers. Two piston ring designs which might give improved performance have been suggested.

N-10881*

National Gas Turbine Establishment (Gt. Brit.)
DATA SHEETS FOR GAS TURBINE REFERENCE FUELS. III - ADMIRALTY REFERENCE FUEL OILS 'NIGHTLIGHT', 'MOTHBALL' & 'TARMAC.' J. J. Macfarlane. June 1951. 17p. diagrs., 7 tabs. (NGTE Memo. M.116)

The report lists the measured physical and chemical properties of the three Admiralty Reference fuel oils code names "Nightlight", "Mothball" and "Tarmac", together with derived data in common use in combustion work.

UNPUBLISHED PAPERS

N-10942*

THE LIFT DISTRIBUTION OVER THE WINGS OF AN AIRPLANE I - SPANWISE LIFT DISTRIBUTION. (La Distribuzione della Portanza sulla Velatura di un Valivolo. I - La Distribuzione della Portanza sull'apertura). Enrico Pistolesi. August 1951. 92p. diagrs. (Trans. from Annali del Registro Aeronautico Italiano, v. 3, no.3, September 1942. 80p.)

Presents a review of methods of calculating the spanwise lift distribution over the wings of an airplane. Includes methods producing quick, and reasonably approximate solutions by simple means, including those obtained by an elaboration in diagrams and tables from one of the theoretical methods. Gives a brief summary of special wing theories, as distinct from Prandtl's simple line vortex, which can be used for the theoretical calculation of the lift distribution along the span as well as along the chord.

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